

## **School-Based Agricultural Education Teachers' Intentions to Use Equipment with Flesh-Sensing Safety Technology**

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### **Abstract**

*The purpose of this quantitative research study was to describe school-based agricultural education (SBAE) teachers' experiences, perceptions, and intentions to use flesh-sensing safety technology (FSST) in SBAE laboratory-based instruction. As emerging technology creates new tools and teaching instruments, SBAE teachers can use this new technology to help reduce student injuries and anxiety associated with using laboratory equipment. A national probabilistic sample was used and a total of 83 SBAE teachers responded to our survey. The Carpentry laboratory was the most commonly ( $f=17$ ; 20.5%) used laboratory for FSST equipment. One quarter (25.3%) of our sample were currently using FSST in their programs and as many as 30 injuries have been prevented via FSST. Overall, the teachers indicated an average of 92.4 ( $SD = 15.8$ ) in the agreement of implementing FSST equipment into their programs. Based on the results of this study, it is recommended to incorporate multiple types of FSST equipment into secondary agricultural education programs to help reduce student injuries and increase teacher retention. Furthermore, it is recommended pre-service teachers be introduced to, and receive training on equipment with FSST while in their teacher prep program. It is also recommended that universities, stakeholders, and state-level agricultural education / FFA staff members seek out resources to equip agricultural education programs with FSST equipment. Further research should be conducted to discover what barriers lie in the way for SBAE programs to obtain equipment with FSST, and what FSST equipment is developing for consumers.*

### **Introduction and Literature Review**

Historically, occupations within the agricultural industry have been considered dangerous (Rivara, 1997; Rudolphi & Retallick, 2015). According to worker fatality statistics, the three most dangerous industries are agriculture, fishing, and forestry which have an eight percent higher fatality rate when compared to all other industries (McKnight & Myers, 2017). A significant amount of effort to reduce the number of injuries or deaths related to agricultural industries is quite evident. These efforts have manifested in multiple ways, such as safer equipment and training, farm safety day camps, state and local fair exhibits, and guest speakers at schools (Rudolphi & Retallick, 2015).

School-based agricultural education teachers (SBAE) have many duties to perform, but, ensuring the safety of students while occupying laboratories is second to none (Dyer & Andreasen, 1999). All Career & Technical Education (CTE) teachers and students face a much higher risk of injury due to the nature of the discipline than all other areas of academics (Toglia, 2007). CTE

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teacher educators, school administrators, and stakeholders must ensure teachers are adequately trained in technical laboratories so they can provide a safe and well-organized environment for students so that optimal learning can take place (Burriss et al., 2005; Hainline & Wells, 2019; Saucier & McKim, 2011).

It has been postulated the quality of technical training in SBAE laboratories has implications for SBAE graduates' decisions to either enter the profession of teaching or not (Rocca, 2005). Safety awareness, practices, and techniques are always evolving within SBAE laboratories, and therefore need constant professional development to stay current for creating a safe environment (Tummons et al., 2017). Shoulders and Myers (2012) noted that 76% of SBAE programs in the United States have a greenhouse, mechanics, woodworking, and welding laboratory. As emerging technology creates new tools and teaching instruments, along with the constant change in students and teachers' demographics, SBAE teachers are tasked with teaching, managing, and facilitating learning activities in these laboratories; however, they only receive minimal formal training from teacher prep institutions (Burriss et al., 2005; Dyer & Andreasen, 1999; Hainline & Wells, 2019; Tummons et al., 2017).

An increase in new and potential dangers, combined with a decline in teacher preparation in technical areas will result in more teachers leaving the profession and a higher risk for injury. Tummons et al. (2017) further indicated pre-service teachers have severe concerns for personal and student safety, technical skill inadequacy, and liability questions regarding student accidents and injuries. Student safety and supervision is a category in educational law, which was found significant in research conducted by Hainline et al. (2019). Research conducted by Hainline and Wells (2019) and Saucier et al. (2012), found SBAE teachers in Iowa and Missouri placed laboratory safety as one of the most important skills needed by beginning teachers.

SBAE teachers are subject to more liabilities due to the nature of the discipline such as maintaining and instructing in laboratories, working with livestock, and FFA events and overnight trips (Dyer & Andreasen, 1999; Hainline et al., 2019). According to Ingersoll et al. (2014), the teacher attrition rate is occurring at an alarming rate of 50% with teachers leaving the profession within the first five years of teaching. Teacher recruitment and retention efforts need to be enhanced. Many former teachers who left the profession credit their departure to poor working conditions, poor leadership, and lack of professional development (Clemons et al., 2018; DiBenedetto et al., 2018; Ingersoll et al., 2014; Smalley et al., 2019).

Pre-service teachers must receive adequate training in safety, operation, and awareness of potential dangers in SBAE laboratories as well as ongoing professional development opportunities throughout their teaching career (Blackburn et al., 2015; Smalley et al., 2019; Tummons et al., 2017). Research indicates professional development for SBAE teachers helps mitigate teacher retention, bolsters teachers' confidence, and self-efficacy (Burriss et al., 2010; Smalley et al., 2019; Touchstone, 2015).

Tummons et al. (2017) reported the last three decades SBAE has been mainly dominated by males who have some type of experience associated with agriculture and the content taught within agricultural curriculum, particularly within laboratories. In recent years, there has been a shift in demographics showing an upward trend in more female teachers and students enrolled in Agricultural Education teacher prep institutions (Burriss et al., 2010; Tummons et al., 2017). With an increase in diverse teachers, who are a part of a society who have become more and more distant from living and working on farms (Phipps et al. 2008), there is a significant need for adequately trained SBAE teachers to properly teach, manage, and facilitate learning activities in SBAE laboratories.

Recent studies have shown, pre-service and induction teachers emphasized they needed rigorous and thorough training in using laboratory equipment, procedures, safety training, safe housekeeping practices, and safe techniques. These all serve as the foundational tenet in creating and maintaining a safe laboratory environment (Smalley et al., 2019; Tummons et al., 2017). McKim and Saucier (2011), reported first-year SBAE teachers indicated managing learning activities in laboratory settings was just as important as having the ability to teach technical content. For SBAE teachers to create and maintain a safe, well-organized, and effective laboratory, they should teach safety techniques early and often to create a safety-first culture.

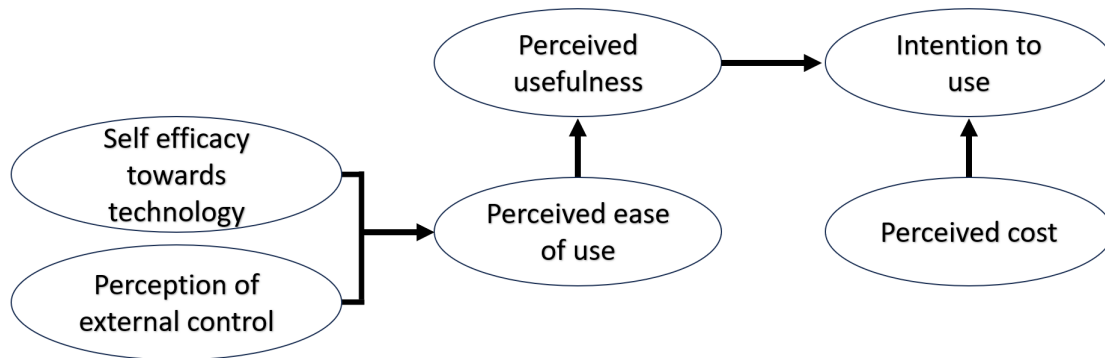
Teachers must first possess the correct training and skills associated with teaching, managing, and facilitating learning activities in SBAE laboratories (Chumbley et al., 2019; Gillen et al., 2013; Saucier & McKim, 2011). Research informs us that adequate laboratory-based training and ongoing professional development for SBAE teachers is the linchpin to teacher retention, quality of instruction, a decrease in teacher liability, and a catalyst to recruit people to the teaching profession (Burriss et al., 2005; Hainline & Wells, 2019; McKim & Saucier, 2011; Rocca, 2005; Shoulders et al., 2013; Smalley et al., 2019). This literature review highlights the plethora of research that emphasizes the need for pre-service teachers to receive required adequate training in SBAE laboratories and the multi-layered benefits that would occur if implemented.

**Conceptual Framework**

This study is guided by the technology acceptance model (TAM) adapted to virtual reality (VR) by Bertrand and Bouchard (2008) (see Figure 1).

**Figure 1.**

*The TAM adapted to the VR model.*



The TAM’s primary reasons for development were to identify the reasons involved in why people accept technology usage and to examine a variety of information concerning technology usage behaviors (Bertrand & Bouchard, 2008). The TAM (Davis, 1985) has proven to be useful for predicting the acceptance, adoption, and use of new technologies (Chen et al., 2011).

The TAM Model (Davis, 1985) has been applied in several recognizable areas of technology such as explaining users’ acceptance of the World-Wide Web (Moon & Kim, 2001), understanding the automotive telematics users’ usage intentions (Chen & Chen, 2009), and understanding customer acceptance of Radio Frequency Identification (RFID) (Muller-Seitz et al., 2009).

Since this study sought to discover if SBAE teachers were willing to use equipment with flesh-sensing safety technology and automatic braking devices, Bertrand and Bouchard’s (2008)

TAM model serves as viable framework to guide and direct this study. The Bertrand and Bouchard (2008) TAM model has slightly augmented categories compared to the TAM (Davis, 1985) to better understand intentions to use technology such as FSST.

The adapted TAM is comprised of six different categories including (1) perceived usefulness, (2) perceived ease of use, (3) the intention of use, (4) perceptions of personal efficacy, (5) perception of external control, and (6) perceived cost. Items encompassed in these categories serve to predict an individual's intentions concerning the use of the new technology (Chen et al., 2011). Similar to the use of the TAM in previous studies, we sought to use the TAM to determine SBAE teachers' intentions to use and implement Flesh Sensing Safety Technology (FSST) in their SBAE laboratories.

### **Purpose and Objectives**

The purpose of this study was to determine SBAE teachers' intentions to use and implement power equipment with FSST in their SBAE laboratories. The following three research objectives guided this study:

1. Describe the demographics of the SBAE teachers represented in this study.
2. Describe the SBAE teachers' past and current experiences with FSST and injuries prevented by way of FSST technology.
3. Describe SBAE teachers' intentions to use flesh-sensing safety technology.

### **Methods**

This study used a descriptive quantitative research design. This study aimed to discover what equipment with flesh-sensing safety technology (FSST) is currently being implemented by SBAE teachers and what injuries may have been prevented via FSST. In addition, this study also sought to describe SBAE teachers' experiences and intentions to use FSST in their laboratories.

### **Instrumentation**

The research instrument used in this study was developed and disseminated via the Qualtrics Survey Platform and contained a total of 26 items. The instrument included five demographic items (i.e., State in which they taught, means of teacher certification, number of years teaching, number of years teaching in a laboratory, whether they had industry experience) and 21 items associated with the teachers' experiences, perceptions, and intentions to use FSST. For each item related to experiences and intentions to use FSST, teachers were asked to indicate their level of agreement with each item on a 100-point visual analog scale (VAS; 0 = *Strongly Disagree* to 100 = *Strongly Agree*). VAS style items were used, as opposed to Likert-type items, to enhance the responsiveness of measurement (du Toit et al., 2002; Hasson & Arnetz, 2005; Paul-Dauphin et al., 1999) and to allow the interpretation of data on a ratio/interval scale level (Myles et al., 1999; Reips & Funke, 2008).

The instrument used in this study was adapted from former technology acceptance questionnaires (Bertrand & Bouchard, 2008; Davis, 1993; Venkatesh, 2000; Venkatesh & Davis, 2000). The main modification that was made to the items derived from the previous instruments was the augmentation of the wording to fit the context of FSST (e.g., "I find / would find it easy to apply FSST to specific content which is currently implemented in my program"). The items associated with the perceived cost of adopting FSST were adapted from the Bertrand and Bouchard (2008) instrument.

The VAS items were grouped and presented in six categories. The technology acceptance categories were: (1) perceived usefulness of FSST, (2) perceived ease of use of FSST, (3) intention

to use FSST, (4) perception of personal efficacy to use FSST, (5) perception of external control toward FSST, and (6) perceived cost of FSST.

Before data collection, the instrument was reviewed by a panel of experts (i.e., five Agricultural Education faculty members) to review for face and content validity. The five members were intentionally selected based on their expertise and experience teaching agricultural mechanics courses at the secondary and university levels. Panel member one was a department chair and professor at a Midwestern University who has created and implemented several laboratory-based SBAE courses for his department's agricultural teacher education program. Panel members two and three were associate professors at regional universities in southern states who at the time of this study taught multiple laboratory-based courses and are well versed in laboratory instructional research. Panel member four was an assistant professor at a regional university in a southern state. He currently teaches five undergraduate courses related to agricultural mechanics. Panel member five was a professor of Agricultural Education for over 30 years. The panel members were asked to review the instrument for content validity and provide feedback and recommendations for improvement.

A post-hoc reliability analysis was conducted to assess the reliability of the survey instrument in this study. The post-hoc test was conducted on attitudinal data collected in the study which yielded a Cronbach's alpha coefficient of .92—which was considered to be an acceptable level of reliability based on the George and Mallery (2003) interpretations.

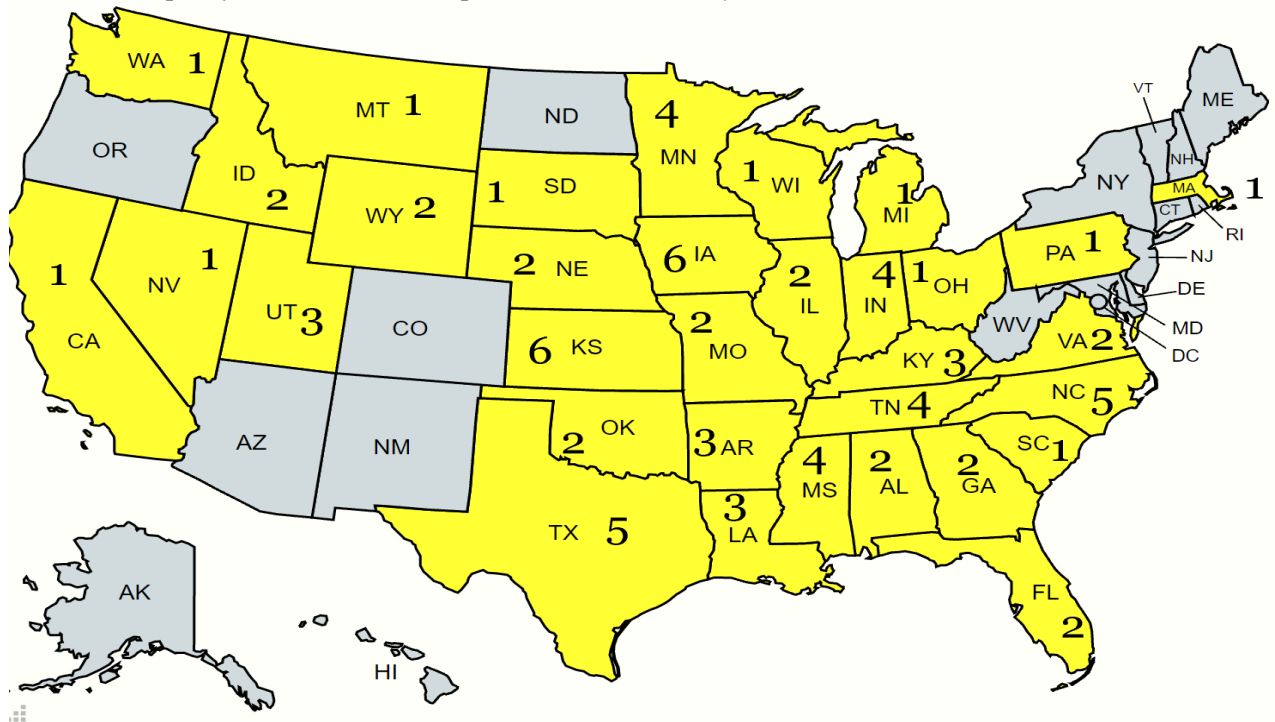
### **Participants**

The target population for this study was all SBAE teachers in America. According to Wells et al., (2021) study, there were roughly 13,500 SBAE teachers in America. Using Dillman et al.'s (2014) probability sampling calculator, a probabilistic sample was calculated of 375 participants. An additional 25 participants were added due to email address changes and position changes making the working sample 400 participants.

Per Dillman et al. (2014), the acceptable amount of sampling error is  $\pm 5\%$  of the true population, with a Z statistic associated with confidence level = 1.96, 95% level. Via email, we contacted the South-Central Local Program Success Specialist at the National FFA Organization, and requested a probabilistic sample of 400 SBAE teachers across the United States. We had a total of 83 SBAE teachers ( $n = 83$ ) who responded to our research instrument, producing a response rate of 22.8%. Recent studies such as Wells et al. (2021), Sherman and Sorensen, (2020) Sorensen et al. (2017), and Easterly and Myers (2017) had very similar response rates. Of the 81 teachers who indicated the state in which they taught, a total of 33 states were represented in this study (see Figure 2).

Figure 2

National Sample of SBAE Teachers Represented in This Study.



**Data collection**

The collection of data in this study was facilitated via the Qualtrics survey platform. The data collection included a total of four separate emails to our participants. The first email provided an overview of the study, associated time commitment for participating, consent form, the incentive for participating in the study (i.e., 20 \$50.00 gift cards drawn at random), and the email included a link for the survey. The subsequent emails were reminders to the participants who had not yet completed the survey. A total of 38 emails bounced reducing the total number of potential respondents to 362. We had a total of 83 SBAE teachers respond to our research instrument.

As per the recommendations from Miller and Smith (1983), we used the double-dipping method to assess non-response error. Specifically, we randomly selected 15% of the non-respondents and asked them to complete the instrument to compare their responses to those who responded to the study (Miller & Smith, 1983). The results of the independent samples *t*-test indicated there were no significant differences between the respondents' and non-respondents' responses; thus, non-response error was not found to be an issue in this study.

**Data Analysis**

The IBM Statistical Package for Social Sciences (SPSS©), Version 25, was used to analyze the data collected from the probabilistic sample. The data analysis for objectives one and two included the calculation of descriptive statistics (i.e., frequency, percentages, means, and standard deviations) to describe the SBAE teachers' demographic and background information, and to describe the SBAE teachers' past and current experiences with FSST and injuries. Measures of central tendency and dispersion were calculated to explore objective three, which was to describe the SBAE teachers' intentions to use FSST in their SBAE laboratories. The items associated with

objective three were coupled with visual analog scales which allowed us to interpret these items as scale level data (Myles et al., 1999; Reips & Funke, 2008).

**Results**

This research instrument sought to discover what equipment with FSST is being implemented by SBAE teachers across the nation and their intentions to use equipment with FSST in the future. A total of 83 SBAE teachers responded to this survey. The SBAE teachers represented in this study taught in 33 different states, had an average of 12.5 (*SD* = 10.0) years of teaching experience, and an average of 13.23 (*SD* = 14.8) years of experience teaching in a laboratory setting. Of the teachers represented in this study, 32 (38.6%) had previous agricultural industry experience prior to pursuing a career in Agricultural Education.

The teachers with agricultural industry experience had occupations such as animal science vet assistant, butcher, pharmaceutical lab technician, purchasing agent for a feed company, USDA research assistant in plant pathology, or a salesperson in agronomy (e.g., fertilizer, seed). Several worked in the residential construction field, as a farmhand (livestock and crops), and as a welder / fabricator.

The table below shows how the teachers (*n* = 83) became certified to teach SBAE. Fifty-eight (69.9%) teachers were certified through an undergraduate-level program, 12 (38.6%) were certified through a graduate-level teacher prep program, seven (8.4%) began teaching after first working in the agricultural industry, three (3.6%) began teaching after first teaching in another content area (i.e., English, science, etc.), and three (3.6%) entered the profession by other means (see Table 1).

**Table 1**

*Teacher Certification Route by SBAE Teachers in This Study*

Characteristic	<i>f</i>	%
Program Type		
Undergraduate-level teacher prep program	58	69.9
Graduate-level teacher prep program	12	38.6
Began teaching after working in industry	7	8.4
Began teaching Ag Ed after teaching another content area	3	3.6
Other	3	3.6

Participants were asked to describe the laboratories in which they currently and have previously taught. Fifty-three (63.9%) teachers taught in an animal science laboratory, 52 (62.7%) teachers teach/taught in a greenhouse, 49 (59%) taught in a welding laboratory, 48 (57.8%) taught in a mechanics laboratory, and 33 (39.8%) taught in a carpentry shop. There were 12 (14.5%) respondents who indicated teaching in another type of laboratory (see Table 2).

**Table 2***Types of Laboratories in Which the Respondents Taught*

Characteristic	<i>f</i>	%
Type of laboratory		
Animal Science	53	63.9
Greenhouse	52	62.7
Welding	49	59.0
Mechanics	48	57.8
Carpentry	33	39.8
Other	12	14.5

A total of 24 (33.7%) teachers who responded to this study indicated they were currently integrating FSST in their SBAE laboratories at the time of this study. Four of the SBAE teachers reported they had integrated FSST technology in multiple laboratories.

Concerning the context in which they implemented this technology, eighteen (21.7%) of the teachers used FSST equipment in a Carpentry shop, 10 (12.0%) of the teachers used FSST equipment in a Mechanics laboratory, and one (1.2%) used FSST equipment in a Welding laboratory (see Table 3).

**Table 3***Laboratories in Which SBAE Teachers Reported FSST Equipment Integration (n = 24)*

Characteristic	<i>f</i>	%
Carpentry	18	21.7
Mechanics	10	12.0
Welding	1	1.2

*Note.* Four teachers implemented FSST equipment in multiple SBAE laboratories.

When the SBAE teachers were asked about their previous experience and exposure to FSST technology, 37 (44.6%) teachers reported seeing FSST used on the internet, 30 (36.1%) teachers had seen FSST equipment in person, and 25 (30.1%) teachers had no experiences with FSST. Moreover, a total of 24 (28.9%) teachers had used FSST in person, 24 (28.9%) teachers currently use FSST equipment in their SBAE laboratories, and seven (8.4%) of the teachers had FSST equipment in a previous laboratory they taught in (see Table 4).

**Table 4**

*Teachers' Reported Exposure / Experience with FSST.*

Characteristic	<i>f</i>	%
Have seen it on the internet	37	44.6
Have seen it in person	30	36.1
No prior experiences	25	30.1
Have used it myself	24	28.9
I currently use equipment with FSST in my laboratory	24	28.9
I previously taught in a laboratory that had equipment with FSST	7	8.4

Next, we asked our participants to identify the number of student injuries that had occurred in their SBAE laboratories associated with the use of band saws and table saws. Moreover, we inquired about the nature of the injury by asking them to specify whether the given incidents involved a laceration or amputation.

Of the teachers (*n* = 80) who responded to this item, a total of 40 students suffered lacerations using a band saw in the teachers' SBAE laboratories. Regarding student injuries involving a table saw, the teachers reported that only five students were lacerated and one student suffered an amputation while using a table saw in their laboratories (see Table 5).

**Table 5**

*Reported Injuries of Students Using Laboratory Equipment (n = 80)*

Equipment Type	Laceration		Amputation	
	<i>f</i>	%	<i>f</i>	%
Band saw	40	50.0	0	0
Table Saw	5	6.25	1	1.25

Next, we sought to understand how many injuries were prevented by way of FSST in the teachers' SBAE laboratories. As indicated above, 28.9% of the participants were using FSST at the time of this study. Seventeen (20.5%) teachers indicated FSST did not prevent any injuries, while seven (8.43%) teachers reported at least one potential student injury was prevented by the halted blade of FSST. The teachers reported that a total of 36 student injuries were prevented by FSST in their SBAE laboratories.

Objective three sought to describe SBAE teachers' perceptions and intentions to use flesh sensing safety technology. A modified version of the technology acceptance model (TAM) questionnaire (Bertrand & Bouchard, 2008) was used to gauge teachers' perceptions of FSST.

For the category of *Perceived Usefulness*, teachers indicated an average of 86.3 ( $SD = 22.1$ ) agreement regarding the perceived usefulness of FSST. Teachers also showed high levels of agreement regarding FSST improving the safety climate of their program ( $M = 83.1, SD = 26.4$ ) and that FSST would enhance the effectiveness of their program to prepare students for opportunities beyond high school ( $M = 78.6, SD = 26.0$ ; see Table 6).

**Table 6**

*Teachers' Perceptions and Intentions to Use FSST.*

Characteristic	<i>n</i>	<i>M</i>	<i>SD</i>
<b>Perceived usefulness</b>			
I find / would find using FSST in my program to be useful.	76	86.3	22.1
I find / would find using FSST improves the safety climate of my program	74	83.1	26.4
Using FSST in my laboratory enhances / would enhance the effectiveness of my program to prepare students for opportunities beyond high school	80	78.6	26.0
<b>Perceived ease of use</b>			
I find / would find FSST to be easy to use in my program.	77	81.1	28.1
Using FSST in my program is / would be easy for me.	73	78.7	25.7
I clearly know / would know how to use FSST in my program to protect my students.	74	74.8	28.4
Using equipment with FSST does not / would not require a lot of mental effort for me as a teacher.	78	73.4	30.2
Using equipment with FSST does not / would not require a lot of mental effort for my students	78	73.3	29.2
<b>Perception of personal efficacy to use FSST</b>			
... if someone showed me how to use it before I used it.	75	83.8	24.5
... if I had previously trained students on equipment with FSST	73	79.6	27.6
... if I could call someone for help if I got stuck	75	77.9	26.2
... if I had seen someone else using it before trying it myself.	77	74.4	26.4
... without coaching from others as I go	73	72.0	28.2
... without technical assistance as I go	74	70.8	28.2
... if I only had user manuals for reference	73	69.9	28.8
... if I had never used it before	74	60.8	32.1
<b>Perception of external control toward FSST</b>			
I find / would find it easy to apply FSST to specific content which is currently implemented in my program	74	77.4	29.7

I have the knowledge necessary to facilitate learning activities involving equipment with FSST.	70	75.3	28.2
FSST is / would be compatible with the current equipment in my laboratory	68	68.2	30.3
<b>Perceived cost of FSST</b>			
Purchasing equipment with FSST is financially costly	77	82.2	24.6
Getting technical support for FSST is financially costly	71	60.6	24.2
Getting training on using FSST is financially costly?	72	53.1	24.2
My ag. program has the financial resources necessary to acquire and maintain FSST in my program.	69	39.3	32.1
<b>Intention of use</b>			
I use / would use FSST in my program to protect my students	79	92.4	15.8

For the category of *Perceived ease of use*, the teachers' average level of agreement ranged from 73.3 to 81.1. The teachers indicated an average of 81.1 ( $SD = 28.1$ ) agreement regarding ease of use of FSST and reported an average agreement of 78.7 ( $SD = 25.7$ ) regarding FSST being easy to use in their programs.

Teachers indicated an average agreement of 74.8 ( $SD = 28.4$ ) in knowing how to use FSST with fidelity to protect their students and an average agreement of 73.4 ( $SD = 30.2$ ) regarding FSST does not require much mental effort to use as a teacher.

For the category of *Perception of personal efficacy to use FSST*, teachers felt they could teach students on FSST equipment if someone showed them how to use it before they did ( $M = 83.8$ ,  $SD = 24.5$ ) and if they previously trained students on FSST equipment ( $M = 79.6$ ,  $SD = 27.6$ ). The teachers indicated the lowest levels of agreement on the *perception of personal efficacy to use FSST* category items associated with their confidence to use the equipment if they only had a user manual for reference ( $M = 69.9$ ,  $SD = 28.8$ ) and if they had never used it before ( $M = 60.8$ ,  $SD = 32.1$ ).

The next category, *Perception of external control toward FSST*, was comprised of three items. The item which teachers showed the highest level of average agreement was "I find / would find it easy to apply FSST to specific content which is currently implemented in my program" ( $M = 77.4$ ,  $SD = 29.7$ ) and the item with the lowest average agreement amongst the teachers was "FSST is / would be compatible with the current equipment in my laboratory" ( $M = 68.2$ ,  $SD = 30.3$ ).

Concerning the items related to the *Perceived cost of FSST*, the teachers showed strong levels of average agreement that purchasing ( $M = 82.2$ ,  $SD = 24.6$ ) FSST equipment would be financially costly and they indicated moderate agreement with the perceived financial cost of getting technical support ( $M = 60.6$ ,  $SD = 24.2$ ) and training ( $M = 53.1$ ,  $SD = 24.2$ ) for using and maintaining FSST equipment. Teachers indicated a low level of agreement ( $M = 39.3$ ,  $SD = 32.1$ ) regarding the statement "My ag. program has the financial resources necessary to acquire and maintain FSST in my program."

When the teachers were asked to indicate their intention to use FSST equipment for student safety in their programs, their average level of agreement was 92.4 ( $SD = 15.8$ ).

### **Conclusions, Limitations, Implications, and Recommendations**

This study provides a national snapshot of SBAE teachers' perceptions and intentions to use equipment with FSST in their school laboratories. Over 60% of our respondents used an Animal Science and a Greenhouse laboratory, and over 50% of our respondents used a Welding and Mechanics laboratory. This finding is consistent with Shoulders and Myers (2012) study except with the addition of an Animal Science laboratory. The Carpentry laboratory was the most commonly ( $f = 17$ ; 20.5%) used laboratory for FSST equipment.

The study sought to discover if using FSST had prevented any injuries. Out of our sample, 28.9% of the SBAE teachers ( $n = 24$ ) were currently using FSST in their programs and the teachers reported that 36 student injuries were prevented from the blade halting technology of FSST.

Discovering teachers' intentions and perceptions regarding incorporating FSST into their programs found teachers' perceptions towards FSST and its usefulness in their programs were in high agreement. With agriculture being identified as one of the three most dangerous industries with fatalities (McKnight & Myers, 2017) it is critical to implement efforts to reduce the number of injuries related to agriculture industries. Based on this study, SBAE teachers were in agreement that FSST would improve the safety climate. A previous study (Rudolphi & Retallick, 2015) indicated the significant amount of efforts being placed into safer equipment and training, farm safety day camps, and guest speakers at schools. The results of this study connects with the TAM and strengthens the perceived usefulness and ease of use of this technology as teachers are highly favorable in working with this technology and implementing it into their programs.

The intention to use the FSST technology was very high among the respondents (92.4%) which indicates how strong SBAE teachers want to have safe learning environments. The high number of respondents which indicated plans to implement this technology shows the perceived usefulness of this technology as indicated in the TAM. According to the TAM Items encompassed in this instrument teachers perceived usefulness and perceptions of perceived ease of use serve as predictors of the individual's intentions concerning the use of the new technology (Chen et al., 2011). Previous studies (Smalley et al., 2019; Tummons et al., 2017) have also presented the need for pre-service laboratory training related to safety techniques, safety training, and housekeeping. Moreover, previous literature noted that teachers must strive to maintain a well-organized laboratory and constantly emphasize safety techniques to create a safety-first environment.

By gaining a more thorough understanding of teachers' perceptions towards implementing FSST within agricultural laboratories, researchers can begin to explore how to better educate and prepare teachers to utilize FSST. The future of SBAE is facing several challenges. As the profession ages, the teachers within the profession are younger and by a majority are further removed from a farming background. Thus, the ever-widening gap of people who lived and worked on a farm, and in which by doing so obtained a certain level of agricultural mechanic's type skills (i.e., general knowledge of electrical systems, mechanical functions, building construction, equipment operation, animal care, etc.), is growing (Moore, 1987; Moore, 1994; McKnight & Myers, 2017). As this gap widens, and younger teachers are replacing veteran teachers, there is an increase in new and potential dangers as well as a decline in teacher preparation in technical areas. All these changes will result in more teachers leaving the profession and a higher risk for injury in the laboratory. The inexperience of these novice teachers might signal a lower self-efficacy towards using these safety devices—possibly hindering the perceived ease of use (Bertrand & Bouchard, 2008).

While our response rate was only 22.8%, we found nonresponse error was not a limitation of our study; therefore, we can generalize our findings to the entire population of SBAE teachers across the United States per Lindner et al. (2001). It is recommended to incorporate multiple types of FSST equipment (i.e., woodcutting band saw, table saw, metal cutting band saw, etc.) to help reduce student injuries and increase teacher retention. Of our sample, only one-quarter were using FSST equipment, which indicates there were barriers for teachers to obtain FSST equipment. What would laboratory instruction look like if all SBAE laboratories were equipped with FSST? What if SBAE teachers knew they had a safeguard on equipment that student injuries occur on the most (i.e., Band saw)?

Findings from Tummons et al. (2017) indicated pre-service teachers have severe concerns for personal and student safety, technical skill inadequacy, and liability questions regarding student accidents and injuries. Student safety and supervision is a category in educational law that was found significant in research conducted by Hainline et al. (2019). Based on this literature and this study's findings, it is recommended that pre-service teachers be introduced to and receive training on equipment with FSST. It is also recommended universities, stakeholders, and state-level agricultural education / FFA staff members seek out resources (i.e., grants, donations, etc.) to equip SBAE programs with FSST equipment.

Reflecting on the Bertrand and Bouchard (2008) TAM adapted model which guided this study, it is evident through the aforementioned findings that this model can be used to determine acceptance or adoption of new technology. As emerging technology creates new tools and teaching instruments, determining SBAE teachers' intentions and perceptions to enhance their programs is vital to program growth.

Further research should be conducted to discover what barriers lie in the way for SBAE programs to obtain equipment with FSST, teachers' perceptions about securing resources (i.e., grants, donations, federal funds, etc.) to buy FSST equipment, what the future of FSST look like in terms of FSST producers making FSST kits for existing equipment, and what new equipment is in the works for incorporating FSST into (i.e., miter saws, circular saws, radial arm saws, etc.).

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